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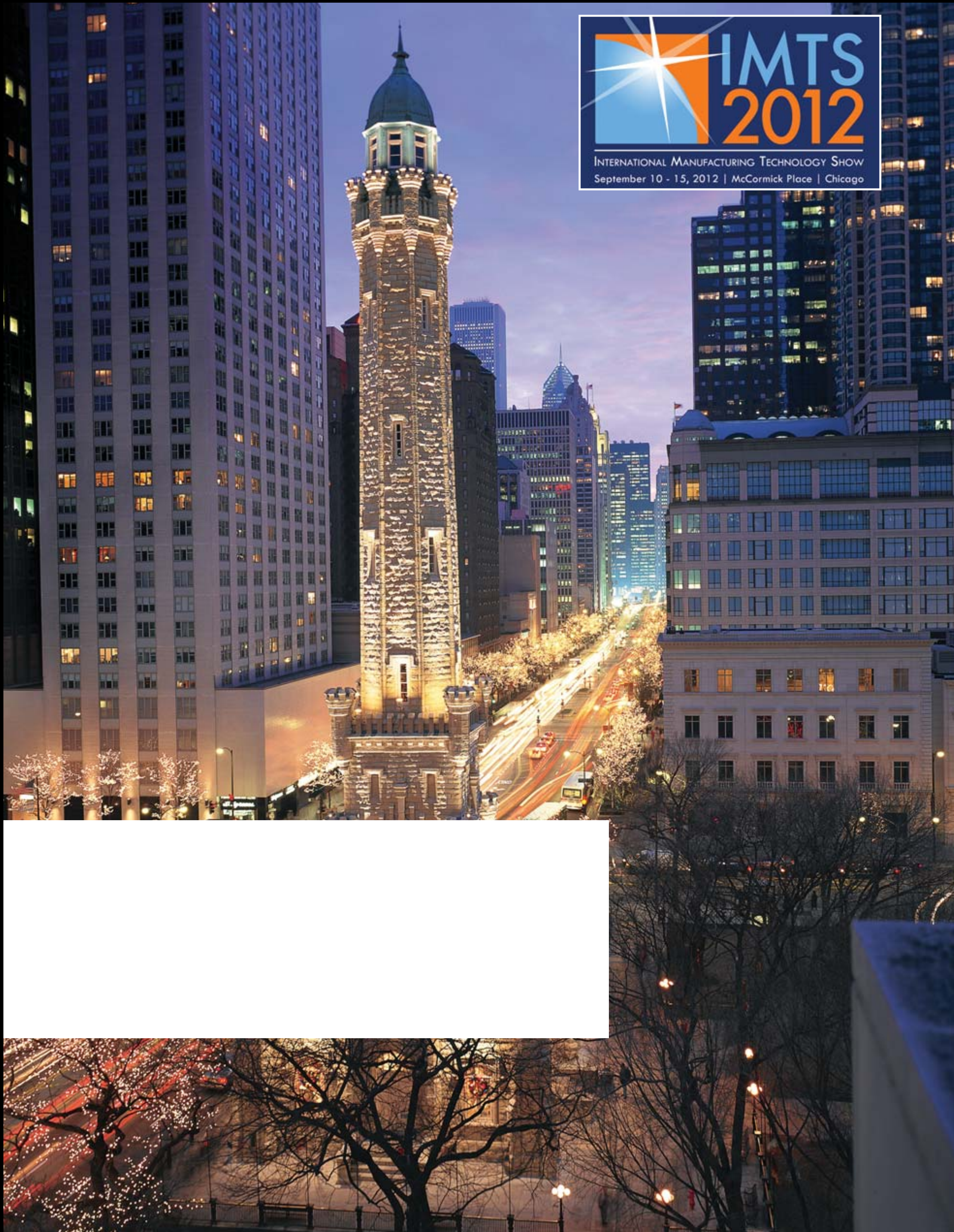
SUPERABRASIVE INDUSTRY REVIEW

Featuring Machine Developments and Innovations – IMTS Preview



IMTS 2012

INTERNATIONAL MANUFACTURING TECHNOLOGY SHOW

September 10 - 15, 2012 | McCormick Place | Chicago

THIS ISSUE

IDA Announces INTERTECH 2013

Calendar of Events

Machines for the Future of Producing Diamond Tooling

News and Notes

IDA Member Companies

A System for Successful Lapping of PCD and CVD Diamond

Announcements & Products

Increased Productivity in the Centerless Grinding of PCD Buttons Through a Combination of Advanced Machine Tools and Innovative Wheel Technologies

THE LONGEST RUNNING MAGAZINE DEDICATED SOLELY TO THE TECHNOLOGY AND APPLICATION OF SUPERABRASIVES

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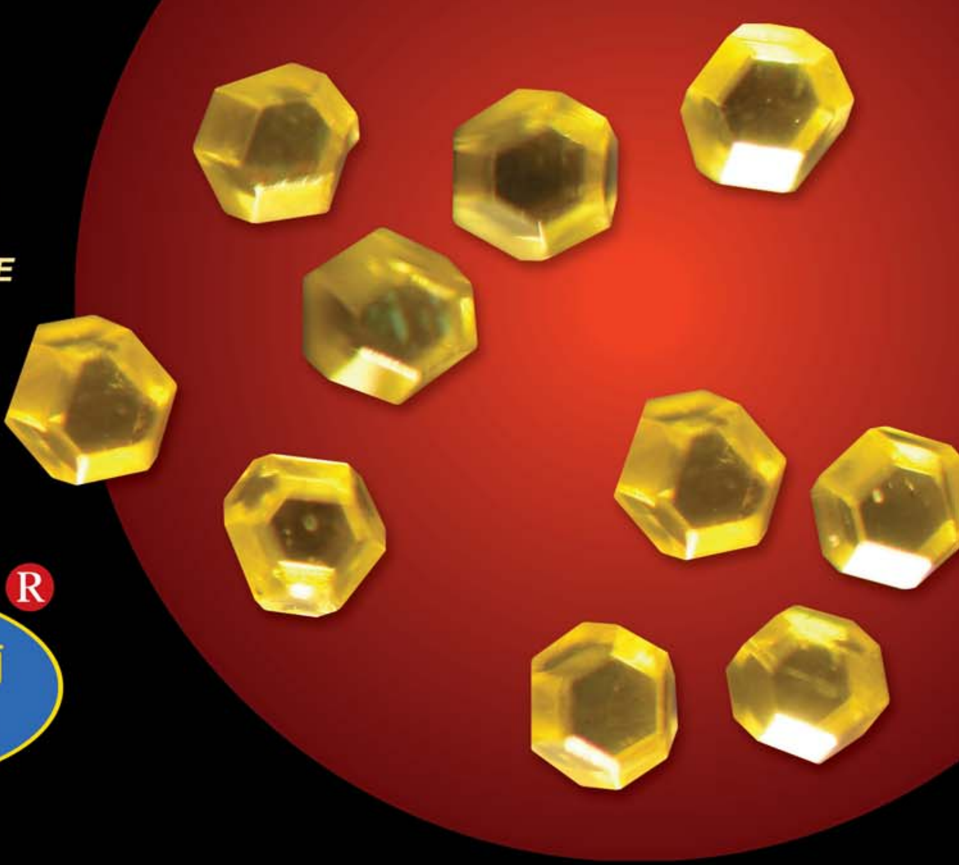

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FINER POINTS is the longest running publication devoted exclusively to the understanding, selection and application of diamond, cubic boron nitride and related materials. It is edited for recipients who are involved in some way with these "superabrasives", either as providers of the materials, producers of products containing the materials or users of these products (e.g., grinding wheels, dressing tools, drill bits, saw blades, sawing wires, cutting tools, polishing compounds, CVD film products, etc.).

COVER PHOTO

Photograph of Chicago's Historic Water Tower on Michigan Avenue, the Magnificent Mile. Chicago is the host for the International Manufacturing Technology Show (IMTS) September 10-15, 2012 at Chicago's McCormick

Photo Credit: © Choose Chicago

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A Finer Point of View…

SUPERABRASIVES AND MACHINE TOOL DEVELOPMENT HAND IN HAND OVER TIME

PRESIDENT
Edward E. Galen

It's hard to believe that for the past 85 years IMTS has been such an important part of our manufacturing lives. It is understandable that the superabrasive industry has paralleled many of the advancements and introductions at the machine tool shows. The first Machine Tool Show was held in 1927, coincidentally, this was also the year that tungsten carbide was introduced as a metal cutting tool and of course this triggered the need for the use of natural industrial diamond as a grinding material. There were two more machine tool shows held in Cleveland in 1929 and 1935, but the next show was postponed as conditions in Europe rapidly deteriorated between 1936 and 1939 with the outbreak of war. After World War II, the next IMTS was held in Chicago in 1947 and billed as the "world's greatest machine tool show" ... the billing was justified and holds true even today. Then in 1955 two things were notable ... first in February, General Electric Company announced the ability to synthesize diamond and later that year a handful of machines were introduced at IMTS that were numerically controlled. These first machines adapted the principle of the electronic computer to design machines to respond to instructions coded in number form on punched or magnetic tape and transmitted electronically to servo-mechanisms that operated the machine tools. CNC was in its infancy as was synthesized diamond and the process for manufacturing diamond on a large scale. This advancement led to a full line of abrasive materials suitably named "super"abrasives. In 1956 cubic boron nitride was invented, then a series of metal-coated abrasives to improve grinding performance. In 1969 cubic boron nitride (cBN) was commercially introduced for grinding hardened steel and a year later polycrystalline diamond and cBN were introduced so a complete line of superabrasives became available for machining and grinding at performance levels never before dreamed possible. In the last four decades machine tools have moved from those first CNC controlled devices to digital wonders. During the 1970's & 80's machines started to evolve with the new computerized technologies. The 80's and 90's saw machines being developed and designed around the capabilities of superabrasives. In fact, technology became the buzz word as The International Machine Tool Show became The International Manufacturing Technology Show in 1990. All at once we started to see machining centers and grinding centers with multiple and interchangeable heads that could perform literally every machining and grinding operation in a single setup. There were high speed grinding heads, high pressure coolant delivery systems, automatic load and unload and manufacturing "cells" that were high performance and extremely profitable. Superabrasives not only provided long life that made these machining and grinding centers possible, they also delivered better surface finishes, less scrap and a metallurgical integrity never seen in the past. Add to this that superabrasives can deliver these results on the exotic new workpiece materials found in aerospace and automotive and one can easily see the way new machines and superabrasives go hand in hand to make IMTS very much an International Manufacturing Technology Show!

With best regards,

Edward E. Galen, President
Industrial Diamond Association of America

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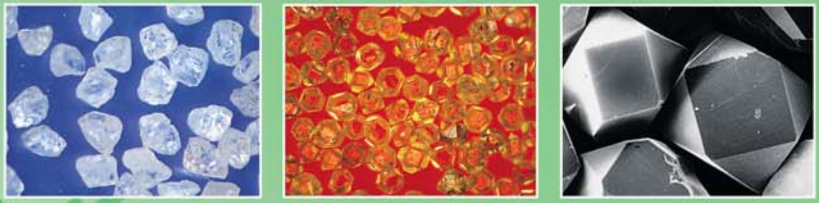

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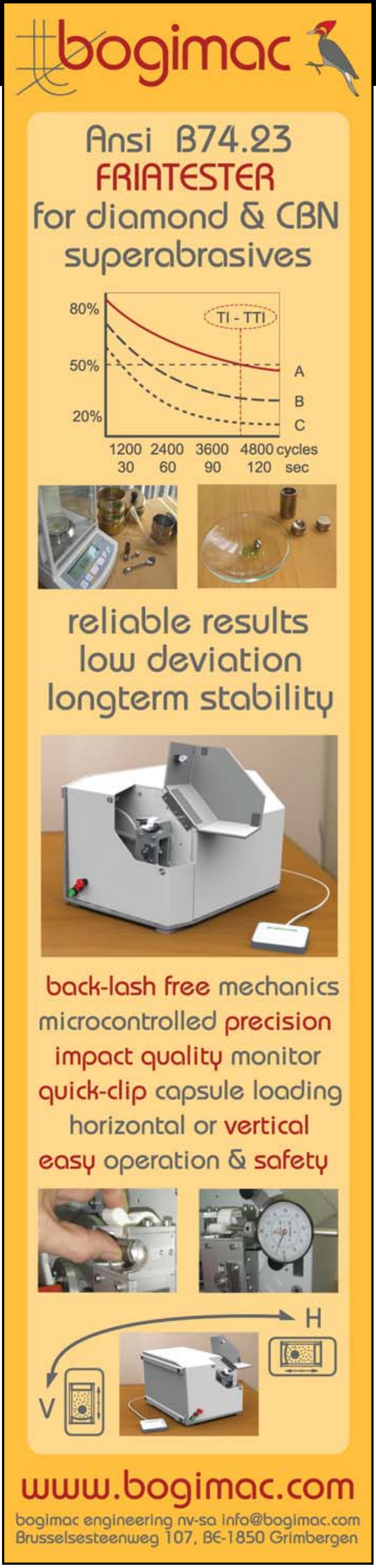
INTERTECH 2013 – Showing and Growing

TERRY KANE, Editor

INTERTECH was the brainchild of the Industrial Diamond Association of America (IDA) Board of Directors back in the late 1990's. The Board looked around and saw a serious need in the industry for an international conference dedicated specifically to superabrasives. Oh, there were other conferences and expositions on various aspects of the industry as there are today, but the IDA wanted a comprehensive conference where the entire program was all about superabrasive materials and their applications. Papers were not only on research and new developments but were all directed at where those new products would fit into a manufacturing operation for performance and profitability! Plus the IDA wanted the entire conference to be non-commercial to add credibility to each paper. The world had heard of superabrasives and they were making inroads everywhere but there was still a need to bring together experts in research, applications and manufacturing in one place to share knowledge and focus on growing the industry. It was a brilliant idea back then and is still a brilliant idea today. I first became involved with the INTERTECH conferences back in 1999 when I was invited to be a part of the first planning committee. The company I was with at that time was an IDA Member and a huge supporter of the conference and it was exciting to be a part of this historical event. Since that time I have taken over as Executive Director of the IDA and continued to be part of organizing and running each INTERTECH. As we plan INTERTECH 2013, I am even more excited to see that each year INTERTECH has grown and prospered with attendees giving rave reviews and encouragement going forward. The INTERTECH has been the springboard for many industrial innovations and always provides significant updates on products and materials used in this industry. INTERTECH is where world leaders in this industry come to learn and share technological advancements. Keynote speakers from the medical, aerospace and automotive have graced the stages at INTERTECH and leading suppliers or manufacturers of superabrasives have shared market trends and global statistics over the years. INTERTECH 2013 will be even better, as the new format will not only include advancements and research in everything from saw diamond to nanodiamond, but will feature a major end user industry such as Aerospace and Automotive. INTERTECH has also been the site of the new educational programs produced by member companies of the IDA. Nowhere else can attendees have the combined expertise of the leading companies in tool making, machine tool building, research, superabrasive materials, grinding, machining and application development all focused in one venue of education. In 2013 the IDA in association with other global organizations we will be hosting the INTERTECH at the Baltimore Inner Harbor Hyatt Regency, a venue keeping with the high standards of INTERTECH. It is a positive sign that we are already receiving inquiries and potential presenters have let it be known they will be introducing new products and using INTERTECH as a launching point for application developments. Watch for details ... No one will want to miss INTERTECH 2013, ***showing*** the world the way superabrasives can be applied and ***growing*** the very industry we all serve!



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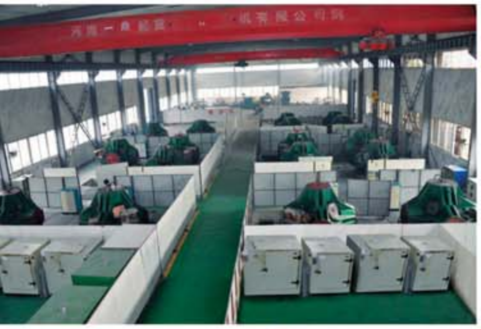
THE FUTURE OF SUPERABRASIVES

Mr. Han Jun, President and CEO of BESCO Superabrasives
Mr. Chris Winkel, President and CEO of WWSA
Mr. John Chalvadakis, Operations Manager of WWSA

- WWSA (Worldwide Superabrasives, LLC) and our joint venture partner, BESCO Superabrasives, proudly announce the expansion of our manufacturing facility in Kaifeng, China.
- WWSA/BESCO, which was founded in 2008, has made a significant investment to increase our plant capacity by over 80% to 60,000 square feet to meet customer demand.
- Included in our expansion is our new superabrasive raw material catalyst production facility—continuing our goal of controlling every part of the superabrasive manufacturing process.
- WWSA/BESCO will produce over 140,000,000 carats of the highest quality resin bond industrial diamond and Cubic Boron Nitride (CBN) in 2012 at our Kaifeng factory.
- WWSA/BESCO will increase the expansion of our manufacturing capacity to no less than 180,000,000 carats by the end of 2013.
- Recent reports indicate that approximately 90% of superabrasive raw materials are manufactured in China—regardless of the name on the label.
- WWSA/BESCO is in a very powerful position for many years into the future as a manufacturer of the highest quality superabrasive raw materials and a provider of world-class technical support, product delivery and customer service.
- IN SUMMARY, WWSA/BESCO will play a significant role in the future of the supply of superabrasive raw materials.



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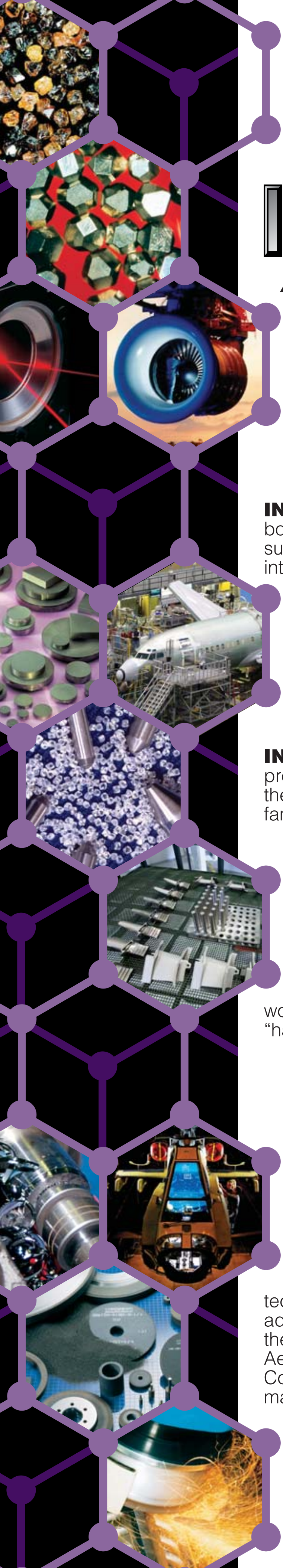

The Industrial Diamond Association of America Announces INTERTECH 2013 May 6, 7 & 8

INTERTECH 2013

An International Technical Conference on Diamond, Cubic Boron Nitride and their applications.

www.intertechconference.com

Hyatt Regency Baltimore Harbor
BALTIMORE, MARYLAND USA
May 6, 7 & 8, 2013

INTERTECH 2013 WILL BE THE FEATURED CONFERENCE FOR NEW TECHNOLOGY AND APPLICATION DEVELOPMENT OF SUPERABRASIVES AND SUPER-HARD MATERIALS FOR AEROSPACE & DEFENSE APPLICATIONS

INTERTECH 2013 is the leading International Technical Conference on industrial diamond, cubic boron nitride, polycrystallines, CVD diamond, Nanodiamond and other materials classified as superabrasives and ultra-hard materials. **INTERTECH 2013** will feature leading experts representing international suppliers, manufacturers, research facilities, academia, end-users, machine tool builders and the scientific community with a focus on Aerospace & Defense industry applications. These areas were selected as our focus due to the high level of exotic materials (titanium, superalloys, high silicon aluminum, ceramics, etc.) used in the manufacture of aerospace and defense components. Those materials can only be effectively machined and ground with superabrasive tooling."

COMPREHENSIVE EDUCATION SESSION
"Superabrasive Materials, Principles & Applications"

INTERTECH 2013 will once again offer, a one-day session covering the history, characteristics and proper application for diamond and cubic boron nitride materials. This updated session will address the essentials of superabrasives for those new to the industry or those who wish to become more familiar with superabrasive materials and applications.

BALTIMORE HARBOR IS A MAJOR ATTRACTION ... This sensational event will be held in Baltimore, Maryland USA at the Hyatt Regency Inner Harbor, conveniently located in the centerpiece of downtown Baltimore. Attendees of **INTERTECH** will want to set some time aside to visit Washington DC the capital of the United States. Less than an hour drive makes Washington a major attraction for attendees. Famous for its historical buildings, the Smithsonian Institute, memorials, statues and shrines, no trip to this vicinity would be complete without a tour of Washington DC for an amazing once in a lifetime experience. **INTERTECH 2013** will be a rewarding technical experience complimented by a trip to the world-famous and historic cities of Baltimore and Washington DC that makes it a "have to attend" event!

Photos of Baltimore for INTERTECH 2013 courtesy of Baltimore Convention & Tourism Bureau.

CALL FOR PAPERS!

YOU CAN BE A PART OF THIS EXCITING EVENT! ... We are now soliciting commercial and technical papers of approximately 30-45 minutes in length that address the research of these super-hard materials as well as the dynamics and application of superabrasive systems in Aerospace and other industries as well (see: Areas of Consideration) with a focus on new technology, tooling, workpiece materials, machines and applications related to increased **PRODUCTIVITY** and **PERFORMANCE**. Consideration for papers is being made at this time and abstracts are now being accepted; contact us today to be considered. This will be the most comprehensive event ever held on superabrasive materials for Aerospace & Defense and similar industries!

AREAS OF CONSIDERATION FOR PAPERS WITH A MAJOR FOCUS ON SUPERABRASIVES USED IN AEROSPACE & DEFENSE APPLICATIONS

AEROSPACE
- Manufacturing
- Rebuilding

MACHINE TOOLS
- Development
- Innovations
- Advancements
- Superabrasive

RESEARCH & DEVELOPMENT
- New Crystals & Abrasives
- New Coatings
- Bond Development
- Testing/Gauging
- Tool Fabrication
- Materials
- Tooling
- Application Development
- Film (CVD & PVD)
- Magnetorheological Finishing
- Electrolytic In-process Dressing (ELID) Mirror-Surface Grinding
- Nanotechnology

TOOLING
- Grinding Wheels
- Cutting Tools
- Drill Bits

WORKPIECE MATERIALS
- High Tech Ceramics
- High Silicon Aluminum
- Glass
- Thermal Sprays
- Titanium
- Superalloys

OTHER NEW TECHNOLOGY & APPLICATION DEVELOPMENT

OTHER INDUSTRIES AND TOPICS FOR CONSIDERATION

AUTOMOTIVE
- Parts Manufacturing
- Gears
- Wheels
- Transmissions
- Engines

CONSTRUCTION/ HIGHWAY
- Concrete Aggregates
- Highway/Runway
- Renovation
- Block Grinding/Polishing

ELECTRONICS
- Disc Texturing
- Wafer Mfg.
- Polishing
- Optic Windows
- Semiconductors
- Heat Sinks

EMERGING TECHNOLOGY
- CVD Diamond
- Nanodiamond
- New Crystals
- Coatings

GLASS
- Lens Generation
- Polishing
- Pencil Edging

MACHINE TOOLS
- Advancements
- Superabrasive Adaptation

MEDICAL
- Surgical Knives
- Prosthesis Fabrication

MINING/DRILLING
- Drills & Bits
- Application

OPTICS
- Polishing
- Lens Generation

RESEARCH & DEVELOPMENT
- HPHT Technology
- Pressing Equipment

TOOLING
- Grinding Wheels
- Cutting Tools
- Sawblades
- Drill Bits

WEAR PARTS
- Rests
- Anvils
- Nozzles

WIRE DRAWING
- Single Crystal
- PCD
- Manufacturing

WOODWORKING
- Hard Woods
- Fiberboard
- Laminates
- Composites

OTHER NEW TECHNOLOGY & APPLICATION DEVELOPMENT

WATCH FOR INTERTECH 2013 ON-LINE

As you can see by the areas for paper consideration, diamond and cubic boron nitride are not just being used as abrasives in traditional applications. Today, superabrasives and ultra-hard materials are making inroads in electronics, medical, cosmetics and literally every other industry where the characteristics of diamond and cubic boron nitride can affect performance or provide higher strength or new capabilities. As an **INTERTECH** attendee you will learn how these new products and applications are being developed, where super-hard materials are being used and how you can apply these systems in new and innovative ways.

Visit the **INTERTECH 2013** website: www.intertechconference.com for additional information on:

- ● CONFERENCE REGISTRATION
- ● SESSIONS & SCHEDULES
- ● SPEAKERS & TOPICS
- ● ORGANIZING COMMITTEE CONTACTS
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- ● TABLETOP DISPLAYS
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- ● VISAS & INVITATION LETTERS
- ● KEYNOTE ADDRESSES

On-Line submission of abstracts is now available at www.intertechconference.com. If you wish to present a paper, you can also send a one or two paragraph abstract of your paper topic via email, fax or regular post to: Terry M. Kane, Chairman • INTERTECH 2013 • P.O. Box 29460 • Columbus, Ohio 43229 • Telephone: 614-797-2265 • Fax: 614-797-2264 • e-mail: tkane-ida@insight.rr.com

ABSTRACTS WILL BE ACCEPTED FROM JULY 1, 2012 THROUGH JANUARY 1, 2013

We will reply to all submissions. Come join us! **INTERTECH 2013** has the tradition of being the most comprehensive event held on superabrasives and ultra-hard materials.

(PLEASE PRINT CLEARLY AND FILL OUT COMPLETELY. *INCLUDE ABSTRACT*)

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Calendar of EVENTS

To have your event or conference listed, please send information to: Finer Points Event Calendar • P.O. Box 29460, Columbus OH 43229 • Fax 614-797-2264 or email: tkane-ida@insight.rr.com

September 10-15, 2012
International Manufacturing Technology Show
McCormack Place • Chicago, Illinois USA
www.imts.com

September 12-13, 2012
TRAM Aerospace Conference Trends in Advanced Machining, Materials and Manufacturing
Chicago, Illinois at IMTS
www.tram-conference.com

October 23-24, 2012
MANUFACTURING WITH COMPOSITES
Charleston Convention Center
North Charleston, SC USA
www.sme.org/mfgcomposites

October 24-25, 2012 • 2012 Global Forecasting & Marketing Conference
Hyatt Regency St. Louis at The Arch
St. Louis, Missouri USA
www.amtonline.org/calendar

November 1-6, 2012 • JIMTOF 2012
Japan Machine Tool Fair
Tokyo International Exhibition Center
Tokyo, Japan • www.jimtof.org

November 12, 2012 • FABTECH 2012
Las Vegas Convention Center
Las Vegas, NV USA
www.fabtechexpo.com

Calendar Events for 2013

January 21-23, 2013
Industrial Diamond Association
ANNUAL MEETING
Disney's Grand Floridian
Orlando, Florida USA
www.superabrasives.org

February 5-8, 2013 • World of Concrete
Las Vegas Convention Center
Las Vegas, NV USA
www.worldofconcrete.com

May 6-8, 2013

INTERTECH 2013
An International Technical Conference on Diamond, Cubic Boron Nitride and their applications.
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BALTIMORE, MARYLAND USA
May 6, 7 & 8, 2013

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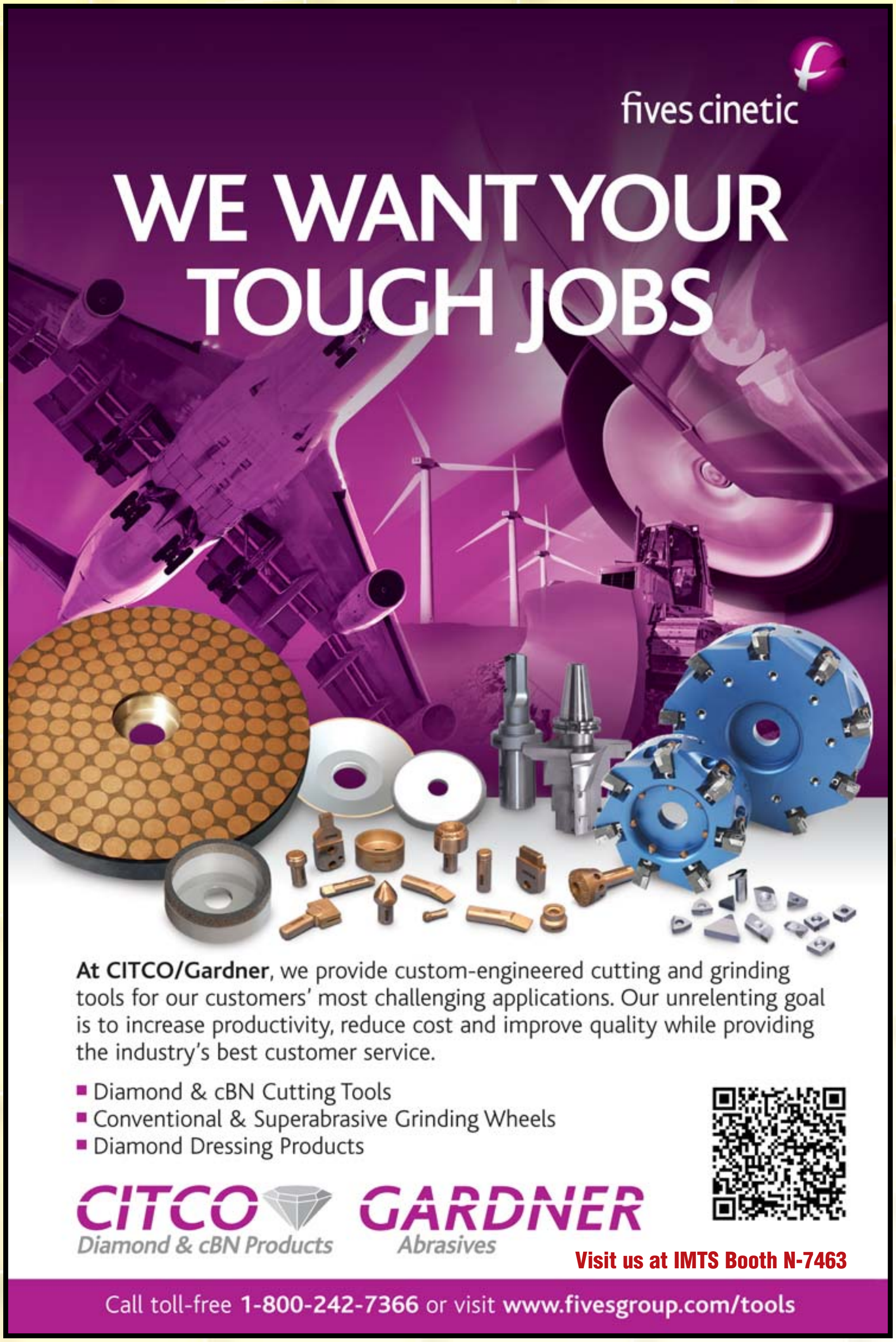

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Vollmer Technical Training Center in Biberach, Germany

Machines for the Future of Producing Diamond Tooling

By: Scott Ries, PCD Division Manager
Vollmer Corporation of America

Innovation and technology continue to drive solutions that increase competitiveness and provide advantages for manufacturers in our global economy. PCD (polycrystalline diamond) tools provide many advantages for the manufacturers to reduce costs by improving tool performance, but technology and innovation are also extremely important for the production of the PCD tools. The QXD series of machines continue to be the platform of the future for Vollmer for the producing diamond tooling used in a wide variety of industries. The QXD series will be highlighted at both IWF, and IMTS, the major technology shows in North America during 2012. This machine technology is used in production of cutting tools for the automotive industry, secondary wood markets, aerospace industry and certain medical related applications. The base of these machines is the concrete polymer structure which provides the high rigidity necessary for production of tight tolerance tools, but the backbone of the QXD series machines lies in the six axes CNC controlled movements that enable a tool designer to reach every point on a cutting tool. This axis flexibility allows the tool designer to create solutions that were not possible even a few years ago. Many of these new designs continue to gain prominence in applications involving the machining and drilling of CFRP materials, machining alloys in automotive applications, and machining wood materials such as MDF, and were responsible for some of the newest machine capabilities.

The flagship of the QXD series is the QXD400 machine. Weighing an impressive 17,000 pounds, this machine can handle large cutters up to 400mm in diameter, and 400mm in length. The machine is delivered fully automated, ready to produce tools and saw blades. It can hold up to 36 cutting tools and a combination of six electrodes and or grinding wheels which allow the programmer to select a variety of operations and strategies for tool processing. This automation provides the capability for the QXD400 to process tools from start to finish in an individual setup, on one machine without removing the tool, holding tolerances of less than 5 micron on the machined surfaces. The QXD200 is slightly smaller with a reduced footprint for processing tools less than 250mm in diameter. The automation on this machine is modular and can be adapted to hold up to 64 cutting tools. The machine also holds six electrodes and/or grinding wheels, and has a software package that enables the complete processing of drills and endmills including production of all fluting and associated geometries.

As a machine tool builder, Vollmer develops machines capable of producing known tool geometries and attempts to incorporate features in anticipation of new designs and tool requirements. Inevitably, our customers, the tool designers develop creative solutions that require additional enhancements of the machine features in order to fulfill their tool requirements. The Vollmer Research and Development team has been working diligently to meet many of these requests and as a result new capabilities for these machines have been introduced to the market about every six months. Many of these new developments are rolled out to the customer base at shows and in seminars at the Technical Training Center located at our corporate headquarters in Biberach, Germany.

PCD tools have been used for many years in automotive applications machining high silicon aluminum components such as engine blocks and transmission housings. As automakers continue to look for avenues to remove weight and increase efficiencies of the vehicle, these materials and composites continue to be utilized. The eroded surface of the PCD has become an industry standard in many of the round tools, but designers had believed and requested a smoother surface for specific applications. (The standard eroded surface is 0.2µRa) Vollmer has incorporated a polishing feature into the QXD series for straight cutting edges. The surface to be polished is eroded to within 10 microns of final dimension and then polished to final size. The polishing process is completed by oscillating a fine diamond wheel along the cut edge with incremental in feed of 1 micron per pass. It is important during this process that the wheel does not leave the diamond surface in order to prevent any fine chipping. This machine

Arndt Hauger, PCD Manager Explaining New QXD200 Features

QXD200 Machine

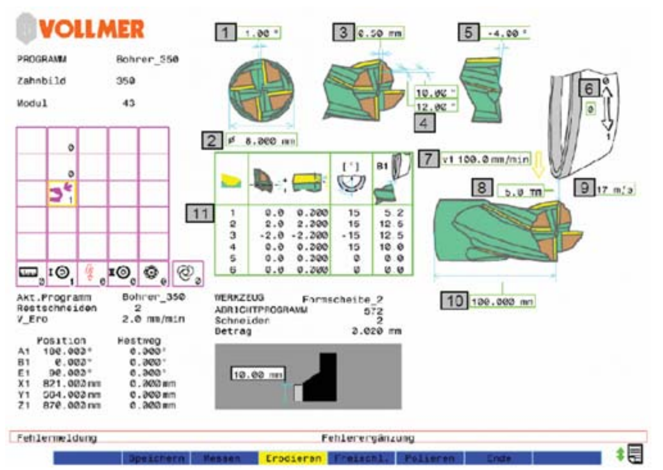
QXD400 Machine

hardware has an audio pickup that detects when the initial contact occurs between the diamond wheel and tool surface. Using this process, finishes of the tool have been measured at 0.04µRa. This improved surface finish resulted in up to a 30% improved tool life in specific applications, and also resulted in a finer finish on the final parts.

Another request from customers involved the ability to erode radius milling cutters. These cutters typically consist of 6-12 tips on a circular body, with the tips fabricated of either 180° or 360° diamond segments which comprise the cutting surface. These cutters are used in the rough processing of the lens components. Prior to the development of this process on the Vollmer machines, these tools were ground using a diamond wheel which proved to be very time consuming and expensive for the tool manufacturer. The operator or tool designer simply creates a .dxf file which along with a few basic geometric entries guides the machines six axes to produce the finished cutting tool. Vollmer was able to create software to finish these tools using rotary electrodes reducing the cost and time involved in their production.

PCD cutter used in lens processing

The manufacturers of drills and endmills have also requested many new enhancements to the QXD200 machine in order to meet requirements when machining composite materials (CFRP) and titanium. Due to the different layers involved in the composite materials, different design strategies have been needed to reduce the delamination when pushing through a completed hole. The trimming aspect of this material has also involved some new tool types which are more helical than traditional end mills. The machining of titanium associated with the aerospace industry has also created demands for new tool designs as well. As a result of these requests, the Vollmer R & D team has developed software and hardware solutions to create non standard drill points such as brad points, and tips with up to five different drill angles. All of these designs serve to change the distribution of forces on the CFRP as the drill pushes through the hole. Modifications to the machine software have also created the ability to machine the veined helical end mills and to grind the gash on the drill tips. This grinding function has proven to be very beneficial on drills when the center point is carbide, and also on carbide portions of the end mill geometries.



PROGRAMM Bohrer_350
Zahnbild 350
Modul 43

			[°]	B1
1	0.0	0.200	15	5.2
2	2.0	2.200	15	12.5
3	-2.0	-2.200	-15	12.5
4	0.0	0.200	15	10.0
5	0.0	0.200	0	0.0
6	0.0	0.200	0	0.0

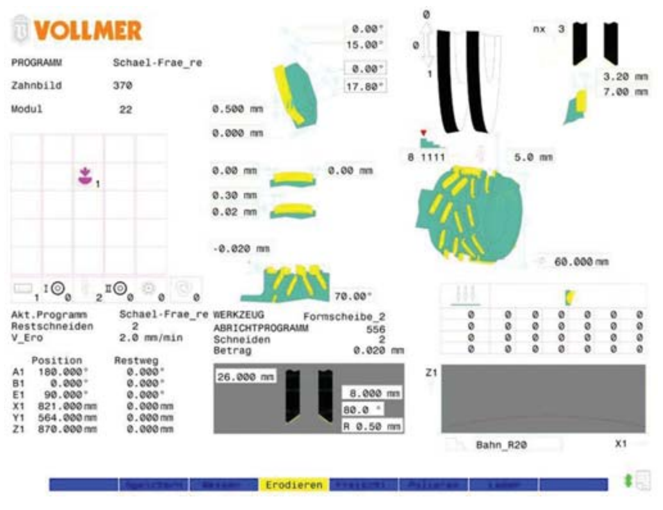
Akt.Programm Bohrer_350
Restschneiden 2
V_Ero 2.0 mm/min

WERKZEUG Formscheibe_2
ABRICHTPROGRAMM 572
Schneiden 2
Betrag 2.020 mm

	Position	Restweg
A1	100.002°	0.000°
B1	0.002°	0.000°
E1	90.002°	0.000°
X1	821.002 mm	0.000 mm
Y1	504.002 mm	0.000 mm
Z1	870.002 mm	0.000 mm

Program Page for Processing Helical End Mills

The demands of companies cutting wood materials such as mdf have also influenced improvements in the QXD machines. The laminated materials in wood also exhibit a tendency to delaminate or splinter which causes unacceptable surface finishes. Many natural wood materials will have chipping occur in the thinner section of the finished lumber which has created the need for cutting tools with higher shear angles. Vollmer has responded with a high shear package that can process tools with shear angles greater than 45°. These tools are completed using new software, and hardware consisting of two copper tungsten rotary electrodes dressed to a trapezoidal shape.



PROGRAMM Schael-Frae_re
Zahnbild 370
Modul 22

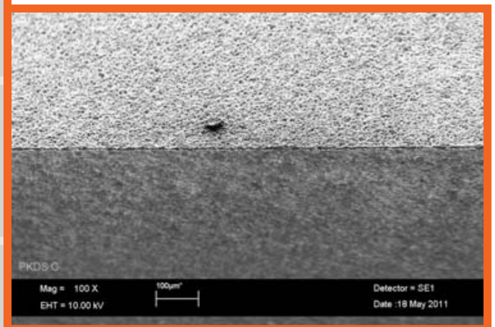
Akt.Programm Schael-Frae_re
Restschneiden 2
V_Ero 2.0 mm/min

WERKZEUG Formscheibe_2
ABRICHTPROGRAMM 556
Schneiden 2
Betrag 0.020 mm

	Position	Restweg
A1	180.000°	0.000°
B1	0.000°	0.000°
E1	90.000°	0.000°
X1	821.000 mm	0.000 mm
Y1	564.000 mm	0.000 mm
Z1	870.000 mm	0.000 mm

Program Page for Processing of High Shear Cutting Tools

The QXD series of machines with six simultaneously controlled CNC axes will continue to be the platform for Vollmer erosion machines in the future. The R &D department is committed to continually upgrading these machines to meet the needs of our ever growing customer base. The designs and applications for PCD materials continue to grow and expand into fields never even considered in the past. As this evolution of materials and processes continue, Vollmer will be there to assist tool manufacturers with methods to produce high accuracy tools in the most cost effective manner possible. ■



Standard Eroded PCD Surface on Top, Polished PCD Surface on Bottom

Innovation and technology continue to drive solutions that increase competitiveness and provide advantages for manufacturers in our global economy.

NEWS and notes

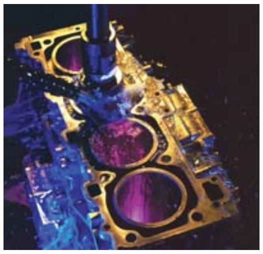
ELEMENT SIX AND THE UNIVERSITY OF WARWICK PARTNERSHIP EXPLORES ELECTROCHEMICAL PROPERTIES OF BORON-DOPED SYNTHETIC DIAMOND ELECTRODES

July 2012 – Element Six, a world leader in synthetic diamond supermaterials, and academic researchers from the University of Warwick's Departments of Chemistry and Physics, have demonstrated the key factors that determine the electrochemical properties of metal-like boron-doped synthetic diamond. The research shows that boron-doped synthetic diamond has outstanding electrochemical properties while retaining the full strength and durability of its chemical structure. This research opens the possibility of exploiting synthetic diamond's electrochemical technologies in a wide range of applications ranging from sensors to electrocatalysis. The boron-doped synthetic diamond electrodes with optimised characteristics will enable electrochemical sensors that have enhanced sensitivity, selectivity and reliability. These sensors would be able to exploit the hard-wearing properties of synthetic diamond while being able to withstand harsh environments and abrasive cleaning. For further information, please contact: Iain Hutchison, Element Six Group Communications and Brand Manager Email: iain.hutchison@e6.com Telephone: +44 (0)20 8742 4949 Mobile: +44 7717 838286

BOEING ANNOUNCES HISTORIC 737 ORDER FROM UNITED AIRLINES

July 2012 – Boeing announced an order by United Continental Holdings, Inc. and its wholly owned subsidiary, United Air Lines, Inc., for 150 737 airplanes, including 100 of the new 737 MAX 9. United, the world's largest airline by traffic, is the latest carrier to choose the newest member of the 737 family, which today eclipsed 10,000 orders overall. The deal, worth $14.7 billion at list prices, also includes 50 Next Generation 737-900ERs. "This order is a major step in building the world's leading airline, and we look forward to offering our customers the modern features and reliability of new Boeing airplanes, while also making our fleet more fuel efficient and environmentally friendly," said Jeff Smisek, United's President and CEO. "To witness the first commercial airplane to surpass 10,000 orders is monumental," said Beverly Wyse, vice president and general manager of the 737 program. "The 737 has continuously evolved and provides improved performance, reliability and exceptional value for our customers." United Airlines and United Express operate an average of 5,605 flights a day to 375 airports on six continents. In 2011, United flew more than two million flights that carried 142 million passengers, more than any other airline. Contact: Bernard Choi Boeing Communications+1 206-766-2917 bernard.choi@boeing.com,

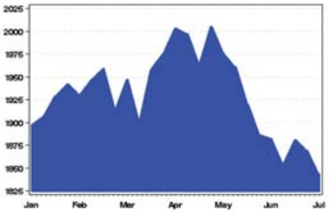
SUNNEN'S NEW SHO-965 HONING OIL EXCEEDS S. CALIFORNIA AIR QUALITY STANDARDS, YET RETAINS THE LONGLASTING, MULTI-USE PROPERTIES OF INDUSTRY-STANDARD MB-30 OIL



July 2012 – Sunnen Products introduces its new SHO-965 honing oil, a super-compliant, low-VOC formulation based on its most widely used general-purpose oil, MB-30. The new oil exceeds the strictest standards of the South Coast Air Quality Management District, the California agency responsible for Orange County and the urban portions of Los Angeles, Riverside and San Bernardino counties – the smoggiest region of the U.S., which also has the highest concentration of metalworking operations in the country. The new SHO-965 oil has a more pleasant odor, yet retains all of the high-performance qualities of industry-standard MB-30 oil, including maximum cutting rates and increased abrasive life when honing difficult materials like stainless steel. SHO-965 is also highly versatile, working on virtually any metal from aluminum to zirconium, and effective as a general cutting oil for screw machines, drilling, tapping and reaming. Its long service life also helps decrease cost per part. For additional information email sales@sunnen.com.

MORE STEEL NEEDED TO MEET HIGHER DEMAND FOR AUTO MAKERS AND OIL/GAS PRODUCTION

Ball State's Dagney Faulk, research director for Ball State's Center for Business and Economic Research (CBER) says U.S. steel production is increasing driven by higher demand for cars and light trucks, and steel for oil and gas production-steel equipment is used in oil shale fields. Steel production came in at 2,003 thousand net tons late April 2012, up from 1,814 thousand net tons a year ago (a 10.4 percent increase). Steel analysts are optimistic that production will continue to increase into for the foreseeable future, she says. For more information, contact Faulk at dgfaulk@bsu.edu or 765-285-5152.



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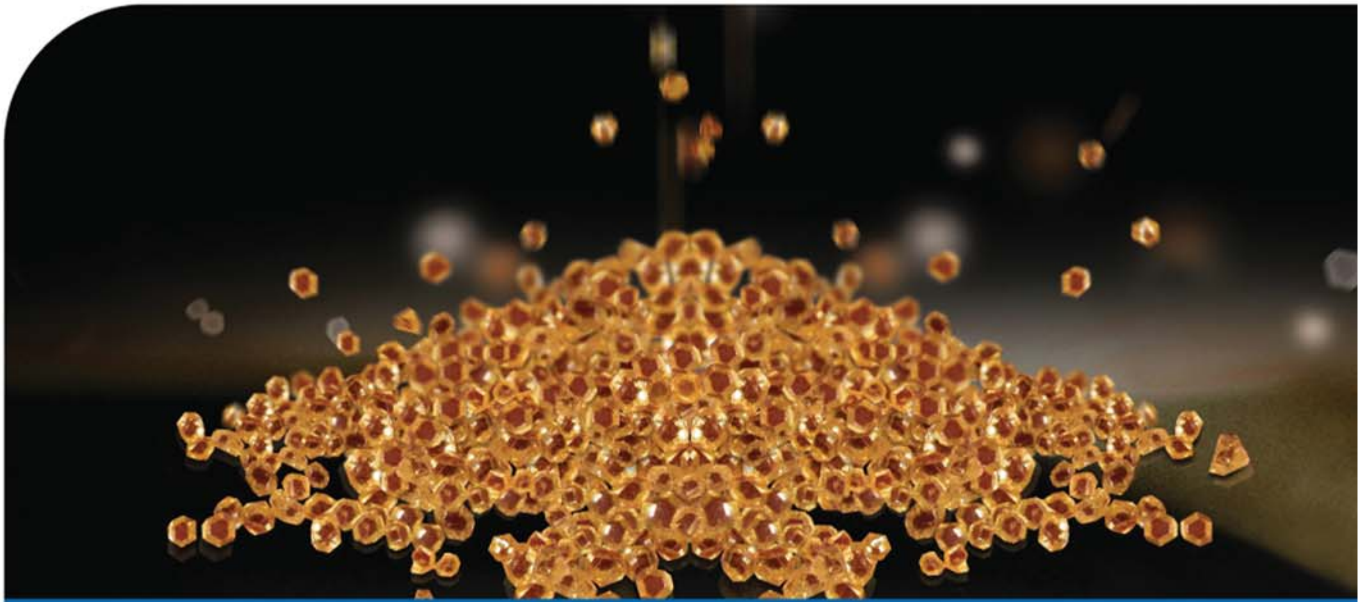

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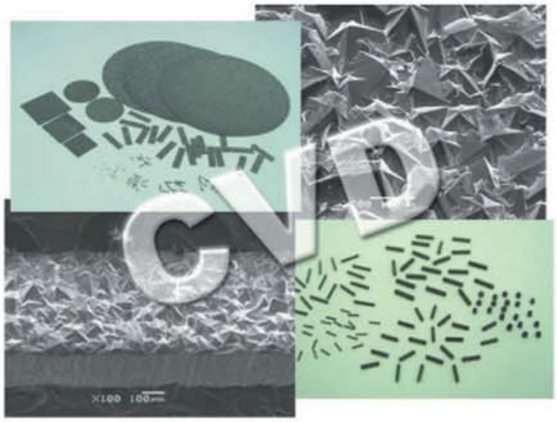

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A SYSTEM FOR SUCCESSFUL LAPPING OF PCD AND CVD DIAMOND

By: Mark Irvin, Hyprez® Product Manager, Engis Corporation

The use of PCD (polycrystalline diamond) and CVD (chemical vapor deposition) diamond has been expanding into a wide variety of industrial, electronics and optics components and applications. While the technologies to produce these materials differ, they present similar challenges in flat lapping and polishing because of the extreme hardness of the materials.

To lap PCD or CVD diamond materials it is necessary to aggressively apply relatively large diamond abrasive particles in engineered slurry formulations against hard plates using robust equipment in order to achieve success.

When lapping with softer conventional abrasive, higher down force is not required. When using diamond, however, more pressure is needed so the abrasive particles abrade, rather than burnish, the workpiece. This downward force is even more critical when lapping PCD and CVD diamond with diamond particles of similar hardness, as there is even less cutting action from the particles and a greater tendency to only have a burnishing action. Providing sufficient load to deliver the abrasive to the work zone can be a daunting challenge requiring:

- *Stiff machine base, spindle and pressure mechanisms*
- *Aggressive abrasive media*
- *Hard plate material*
- *Exacting lap plate preparation*

It has been shown that, in order to optimize the plate preparation process, the use of lap plate facing technology to planarize, texture and cut spiral microgrooves in cast iron plates, results in increased lap rates and, therefore, reduced processing times.

This facing technology, when coupled with engineered diamond slurry, achieves consistent lap rates between 1µm/min and 8µm/min, depending on the surface condition of the parts. (Rough as-grown parts will lap faster than ones which have already been planarized.) These results represent a great advancement from more conventional lapping approaches which required more processing time. The bottom line is reduced costs for equipment, consumables, labor and most importantly, higher throughput.

Advanced Plate Preparation

Free abrasive lapping is a four-body process that involves an abrasive, a carrier (paste or liquid) that is

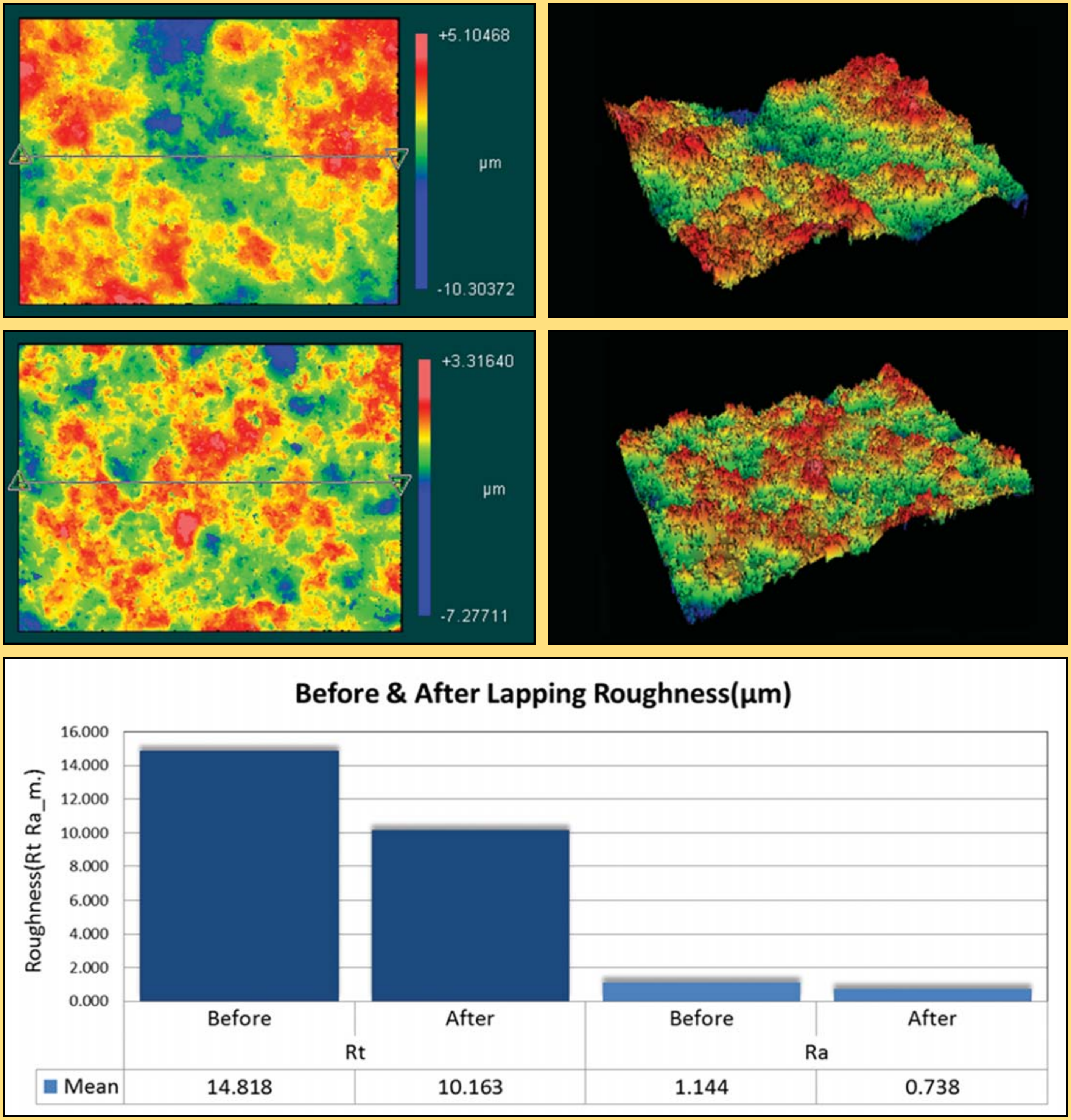


FIGURE 1: Surface mapping of a PCD diamond surface prior to (top image) and after rough lapping (middle image) – images generated using a Zygo white light interferometer – random surface finish results.

applied between the workpiece surface and a lapping plate. While some of the diamond particles contained in the carrier become embedded in the lapping plate to perform a fine grinding action, abrasive particles may also be continuously loose and rolling ("free particles"- see Fig. 2). The lapping process works by pushing the points of the diamond grains into the work surface to abrade microchips of workpiece material, a process well suited to brittle-fracture materials such as hard ceramics. As a result, lapped surfaces do not have directional marks.

Material removal rate in the lapping process is a function of relative work speed, time and pressure. Pressure is defined as load per unit area and is determined by the contact

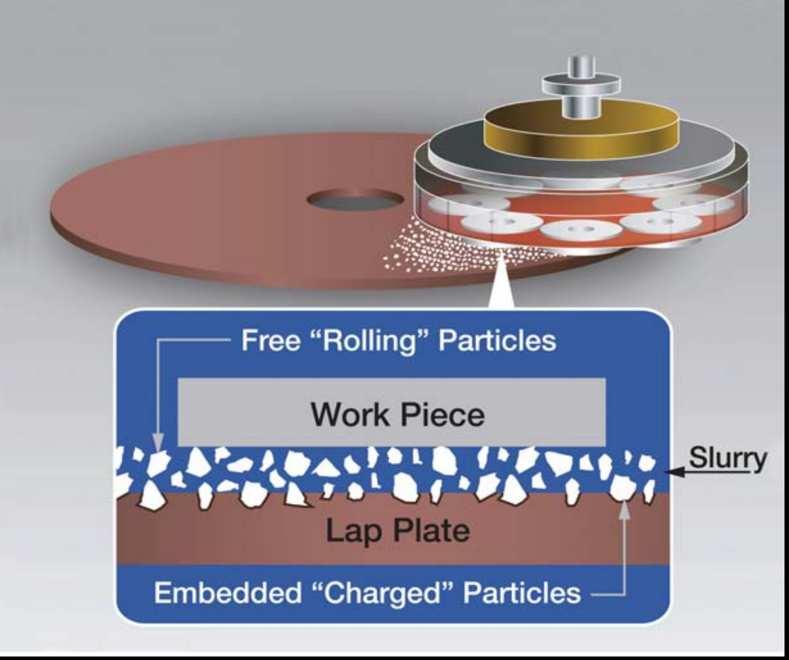


FIGURE 2: Lapping uses a combination of embedded and free diamond abrasive particles.

area (bearing ratio) of lap plate on the work surface. Material removal rate is explained in Preston's equation as follows:

$MRR = Kp(P)vr$ where
MRR = Material Removal Rate
Kp = Preston Coefficient (process dependent)
P = Pressure (load/area)
Vr = Relative lapping velocity

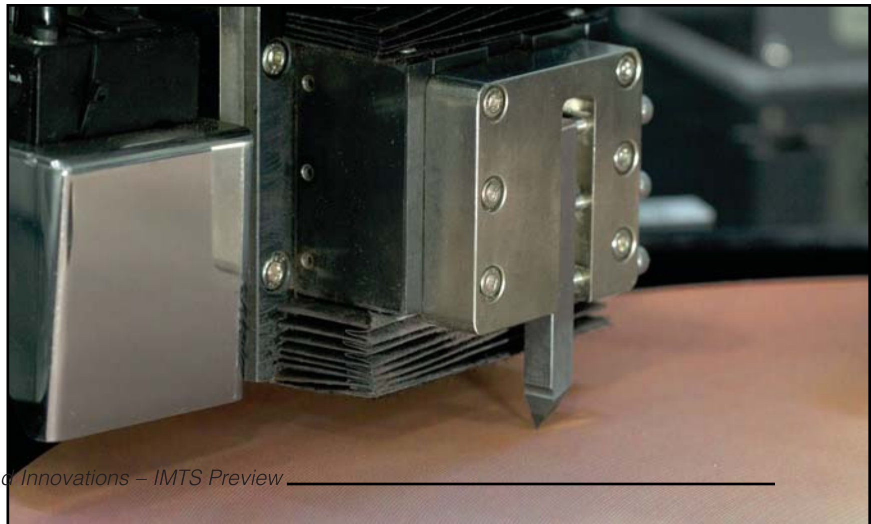
So a flat plate that presents itself well to the work surface will maintain this pressure at the interface between plate, abrasive particle and workpiece, resulting in a steady material removal rate.

What is more challenging in the case of PCD or CVD diamond lapping is the extreme workpiece resistance; high loads strain the interface between the lap plate and the particle and, as a result, any embedded particles strip away and the plate surface rapidly degrades. Rolling particles then do the bulk of the work but only to the extent that strong support from the plate and equipment allow. Efficient, repeatable plate surfacing is required because in a lapping process that utilizes high pressures, large particle abrasive and tough workpieces, the lap plate will lose flatness over the course of a process cycle.

The traditional method to define plate flatness and groove configuration involves using conditioning rings (rotating in a planetary motion with the lap plate rotation) and the experience of a highly skilled operator. While results are generally satisfactory, it is a demanding task, resulting in machine downtime and unpredictable material removal rates. Optical micrographs and image analysis software reveal that this process imparts a random texture and an uneven "bearing ratio" (the percentage of surface area with which the workpiece will ultimately come in contact).

The preferred method for lapping PCD and CVD diamond utilizes a plate facing (machining) device which uses a turning tool bit to remove the top worn layer of the lapping plate, machining it flat to within microns. To then produce a controlled surface geometry and texture, the device makes a second pass at a different feed-rate, machining a groove pattern that serves as a basis for structured embedding of abrasive particles. Controlling the overall plate flatness, groove pattern (macro texture) and lands (micro texture) of the plate surface results in a more consistent bearing ratio. A consistent bearing ratio means consistent unit load and removal rates and incidentally, consistent surface finishes. The groove also aids in clearing away lapping debris and spent slurry.

In most diamond lapping applications a soft metal or metal composite plate is the choice in lapping softer materials to high finishes. For these plates a PCD or single-crystal diamond turning bit will be used. But in lapping PCD or CVD diamond higher plate strength and wear resistance is in order, so cast iron is the choice. In this instance the facing bit used is tungsten carbide. As mentioned, due to the hardness of cast iron plate material when compared to



standard composite metal plates, the facing mechanism must be very rigid, with robust drives and ballscrew to produce flat, controllable surface and grooves.

Besides their role in carrying away debris and in controlling bearing area and unit load, the groove also plays a role in presenting the abrasive particle to the work, especially in the case of large particles. What's more the texture of the lands is a factor in effective particle retention and plate aggressiveness. So, in effect, we are designing our plate macro and micro texture to suit the slurry. In this task the programmability of the facing device is of great advantage in optimizing the plate surface

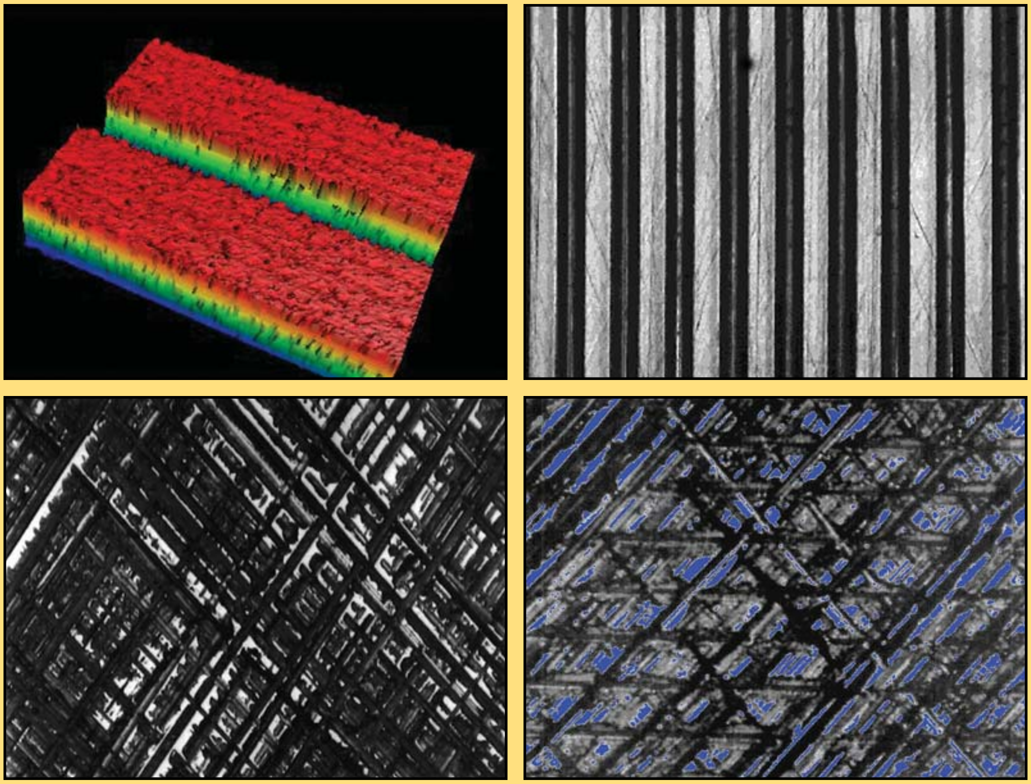


FIGURE 3: Magnified views of textured plates. AT TOP: Examples of controlled textured surfaces with defined surface areas. AT BOTTOM: An example of a random texture. The enhanced view shows the bearing, or working, area in blue.

New Water-Based Diamond Slurry

It was found that standard slurry formulations were inadequate for operating within the higher lapping forces required for PCD and CVD diamond processing. A new diamond slurry was developed specifically for this purpose with a carrier that is thixotropic and maintains an even diamond particle suspension without stirring for long periods of time. Given the rough texture of the lap plate, this formulation allows for easy distribution of the slurry and full plate wetting. The key is for the carrier to evenly coat the plate but thin down as shear forces come into play between the workpiece and cast iron lap plate. An additional advantage of this water based slurry formulation is that it was easy to clean and environmentally friendly. Because large (generally 30-150 micron) diamond particles are required for this application, a tough synthetic monocrystalline particle type was selected for its ability to withstand the elevated loads and resist breakdown. ■

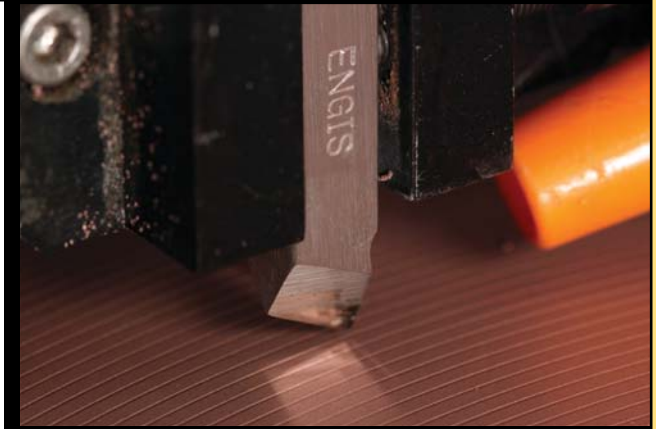


FIGURE 4: A facing device uses a diamond tool bit to remove the top (worn) layer of the lapping plate, machining it flat to within microns. It simplifies reconditioning of the lapping plate. A micro-groove is shown.

CONCLUSION

PCD and CVD diamond components can be lapped and polished but only with significant modifications to the traditional process. Lapping superhard materials requires significantly greater pressures so that the diamond particles can begin to abrade, rather than burnish, the parts. This down force can only be achieved by using robust machinery and properly prepared cast iron plates. In addition, the diamond particles used in the process should be relatively large and durable and applied to the work zone with a thixotropic carrier which fully wets the plate and breaks down efficiently in the process.

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Summer 2012	CVD Diamond & cBN	May 31, 2012
Fall 2012	IMTS Issue (Machines and New Technology)	July 1, 2012
Winter 2012/2013	INTERTECH 2013 Registration Packet	Sept. 30, 2012
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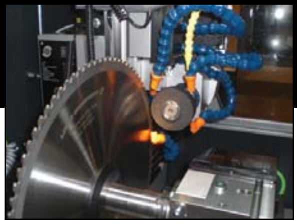
SONOSCAN® has unveiled its newest Lab Model 9600™ C-SAM® Acoustic Micro Imaging System, specifically designed to serve as a general-purpose tool for laboratory/failure analysis work of for low-volume production inspection.

July 2012 – Like the recently introduced technology-laden Gen6™ system, Model 9600 incorporates advanced Sonolytics™ software and its highly-rated graphical user interface. With the Gen6 and the 9600 Sonoscan has raised the performance level for laboratory acoustic microscopes. The 9600 in particular is designed to put Sonoscan quality in the hands of budget-conscious users. Standard in the 9600 is PolyGate™ analysis software, which has proven its usefulness in imaging multilayer or bulk materials. PolyGate permits the user to set up to 100 individual gates per channel for a sample. During a single scan, PolyGate produces a separate acoustic image for each gate. Depending on the material, each gate may be as thin as 20 microns. The 9600 employs a linear motor for X-axis scanning, a tower mounted scan reference platform, and is rated for Class 1000 cleanroom operation. It has a full portfolio of optional features. ***For more information go to: www.sonoscan.com***



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INCREASED PRODUCTIVITY IN THE CENTERLESS GRINDING OF PCD BUTTONS THROUGH A COMBINATION OF ADVANCED MACHINE TOOLS AND INNOVATIVE WHEEL TECHNOLOGIES

By: William Pflager - Landis Cinetic, Ken Saucier & Mike Hitchiner - Saint-Gobain Abrasives

ABSTRACT

A major cost in the finishing of PCD buttons for energy exploration and cutting tool manufacturing is the centerless grinding of the raw PCD furnaced product (including carbide support backing) using resin bond diamond wheels. Historically, Grinding (G) Ratio values have been limited to less than 0.015! This article reports dramatic improvements to this process by utilizing the latest in centerless grinder design in combination with recent advances in diamond wheel technology. By taking such a systems approach, and applying it to the Landis Cincinnati Viking SuperSeries II Centerless Grinder with a new hybrid wheel technology from Saint-Gobain Abrasives, it has proved possible to triple both the Grinding Ratios and the Material Removal Rates, while eliminating stick dressing and allowing for the potential to automate the process. These improvements are expected to create significant, if not industry-changing, cost reductions for the manufacturers of PCD buttons.

Introduction

The processing of hard brittle materials such as silicon, glass, oxide-, carbide- and nitride-based ceramic materials, both in the form of monolithic structures, e.g. wafers, and as coatings have taken abrasive technologies that were purely university research 40 years ago to a multi-billion dollar business today. Leading this growth is probably electronics but many applications require the high uniformity, fracture strength and hardness, at both ambient and elevated temperatures, offered by these materials. Abrasive machining (grinding, wire saw, polishing etc) represents up to 80% of total processing costs.

Grinding of ceramics is characterized by often high normal forces (Fn/Ft up to 20 especially in ductile mode grind along with U' values as high as 800J/cu mm), G Ratios in the 50 – 500 range, and sub-micron flatness, finish and sub-surface damage requirements. These factors have in turn generated a huge demand for ultra-stiff, high accuracy grinding systems, for advances in bond and abrasive technologies, and innovations in processing strategies. For example, at one extreme, ultra-fine grain resin and vitrified bond diamond wheels can produce finishes on silicon wafers measured in nanometers or even Angstroms, while advanced metal/resin hybrid diamond wheels can take a 0.5mm depth of cut on tungsten carbide in peel grind mode while being capable of being automatically dressed with diamond truers in process. However, when considering hard brittle materials, diamond stands in a league on its own. Its hardness is double that of CBN for example and it is up to 10 times harder than many of the materials mentioned above. Unfortunately, what makes diamond such an attractive abrasive for hard brittle materials creates major difficulties when grinding diamond itself. Demand is growing for PCD in particular both for cutting inserts, and in drills for energy exploration. Most research and trade reports focus on PCD

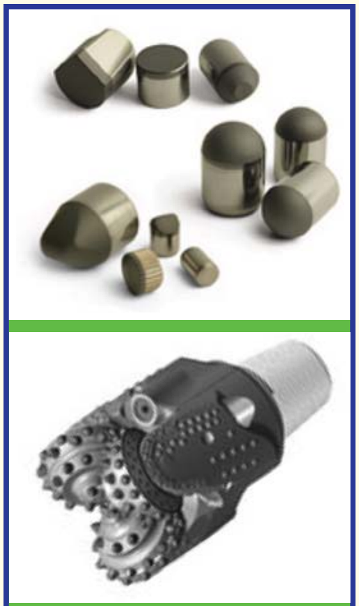
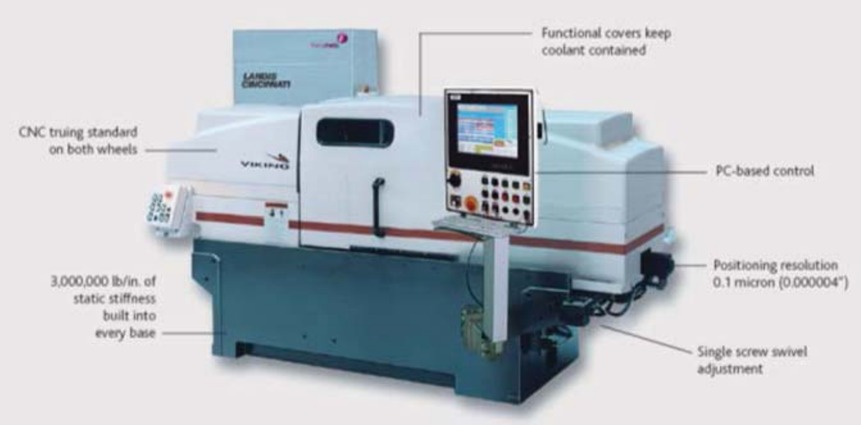


FIGURE 1: EXAMPLE OF PCD PELLETS AND APPLICATION


Functional covers keep coolant contained
CNC truing standard on both wheels
PC-based control
3,000,000 lb/in. of static stiffness built into every base
Positioning resolution 0.1 micron (0.000004")
Single screw swivel adjustment
LANDIS CINCINNATI
VIKING

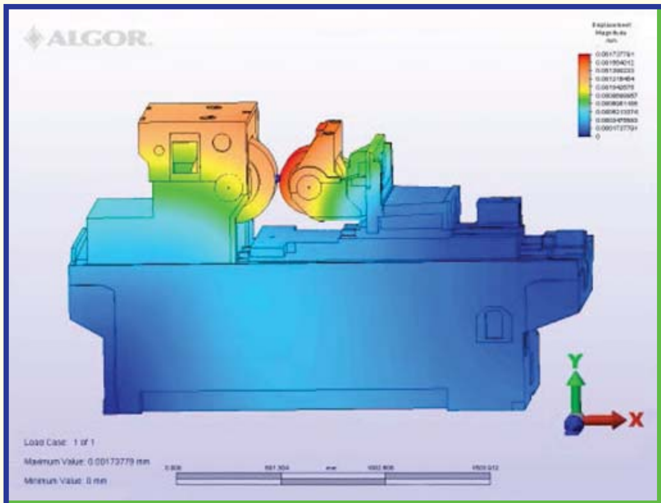
LANDIS CINCINNATI VIKING SUPERSERIES II CENTERLESS GRINDING MACHINE

grinding for shaping tool insert and in particular edge preparation. 600 -1200# diamond sizes in vitrified bonds are typical while G Ratios are barely 0.002 – 0.008.or, in rough grinding, perhaps G = 0.012; *four to five orders of magnitude* lower than G Ratios grinding carbide or steel tools.

PCD inserts are made from sintered diamond round pellets pressed on carbide substrates in high temperature diamond presses. After sintering these pellets must be face lapped and rough centerless ground. The centerless process is a somewhat overlooked, but extremely high consumer of resin bond diamond wheels, traditionally using quite low technology grinders and crude grinding conditions. G Ratio values again have in the past failed to exceed 0.015. In fact any development in wheel technology can be viewed more as a “resistance to dressing” by the PCD material. Landis Cinetic and Saint-Gobain Abrasives (SGA) in taking stock of the status of grinding hard brittle materials and grinding PCD in particular, proposed to evaluate the potential improvements in taking the state-of-the-art in high stiffness centerless grinders and combining it with the latest in hybrid bond wheel technology for PCD pellet rough grinding.

The Landis Cincinnati Viking SuperSeries II® Centerless Grinder* design was the result of the combined effort between the National Center for Manufacturing Sciences, key user groups and Cinetic Landis Corporation, to produce a quantum-leap in machine capability for the next generation centerless grinder. It was computer designed from the ground up, and incorporated many customer-driven features to make it a value-priced, highly productive, operator-friendly machine. The Viking grinder’s unique high rigidity design allowed it to span the spectrum from the standard conventional grinding to advanced hard metals and ceramics processing to submicron accuracy.

The resulting commercial grinder features a nodular cast iron base for strength, stability and vibration damping. Its overall machine static stiffness is an industry leading 525N/µm (3,000,000+ lb/in). Both the grinding and regulating wheels utilize twin-grip mounting to eliminate orbiting and resist wheel separating pressures under heavy loads. A repeatability of 0.25µm is achieved by a 100nm control resolution, 64mm diameter ball screws, dual-axis slide drives, linear scale feedback and A.C.



GRINDING WHEEL

Maximum Distance (Standard)	16” (405 mm)
(Optional)	18” (455 mm)
Hole Size	8” (205 mm)

REGULATING WHEEL

Maximum Diameter	12” (305 mm)
Hole Size	7” (178 mm)

MACHINE CAPACITIES

Work Diameter	0.05 to 2.4” (1.2 to 60 mm)
Grinding Wheel Width	8” (205 mm)
Regulating Wheel Width	10” (255 mm)
Main Drive Horsepower	20 hp (15 kW)
Optional	40 hp (30 kW)
Surface Speed	8,500 sfpm (45 m/s)
Optional – Conventional Abrasives	12,000 sfpm (60 m/s)
Optional – Superabrasives	16,000 sfpm (80 m/s)
Regulating Wheel Speeds	10 to 600 rpm
Machine Weight	20,000 lb. (9072 kg)

FIGURE 2: THE LANDIS CINCINNATI VIKING SUPERSERIES II CENTERLESS GRINDER

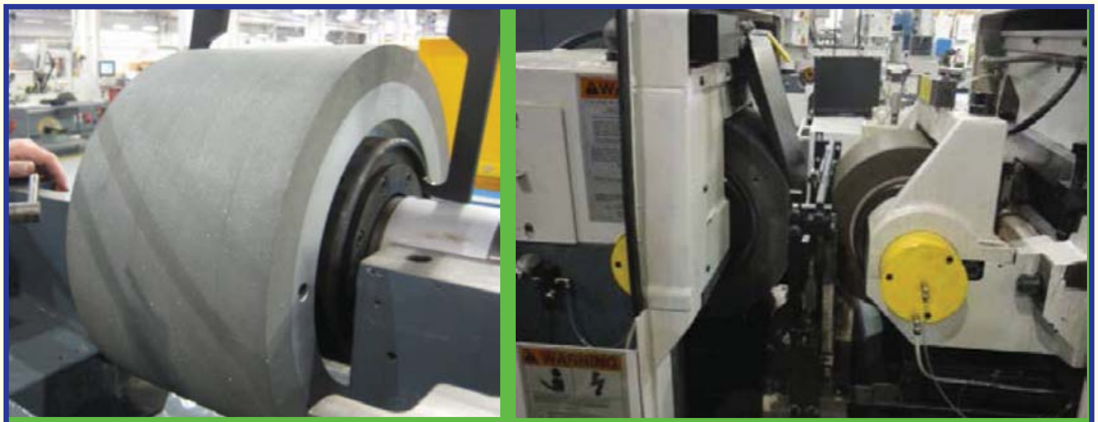


FIGURE 3: EXAMPLES OF NEW HYBRID BOND TECHNOLOGY CENTERLESS WHEELS FOR PCD GRINDING (NOTE THE THICKNESS OF THE DIAMOND LAYER)

brushless servomotors. The Viking has a standard 20 hp or optional 40 hp drive at the grinding wheel. Wheel speed ranges from a standard 43m/s up to an optional 60m/s for conventional abrasives and 100m/s for superabrasives. The stiffness improvement over standard grinders has, for example, already proved particularly effective in grinding of tungsten carbide at 90HrC with diamond wheels where it typically cut processing time by as much as 66%, hence raising the interest in its application for grinding PCD. Processing has been further enhanced by an innovative wheel cleaning system.

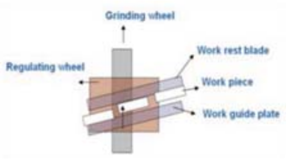
Saint-Gobain Abrasives (SGA) Hybrid Wheel Technology

SGA has for several years been developing and expanding its technology in hybrid bond technology, especially for diamond abrasive, focused on high volume carbide production, ceramics grinding and PCD and PCBN insert grinding. In particular, the optimization of extremely high strength bonds have allowed for low bond volume, lower grinding forces and a greater ease of dressing with comparable or often much higher G Ratio values than traditional single-component resin or vitrified bond wheels. The technology has also proved readily transferable to the manufacture of large thru-feed centerless wheels suitable for use on the Viking grinder.

Baseline Evaluation of Wheel Performance – Low Stiffness Simulation

Initial testing was carried out at Higgins Grinding Technology Center using a Dedtru centerless system on a surface grinder to simulate a typical low stiffness machine configuration. Tests were made to compare the standard resin diamond wheel grade common in use in the field with the latest bond technology on a grade of commercially available PCD round inserts with carbide backings. The wheels were both first dressed offline using aluminum oxide wheel between centers. All tests were made at the same grinding wheel and regulating wheel speed and machine settings with the workpieces fed individually. Adjustments were made to find the maximum depth of cut and thru-feed. G Ratio calculations assumed the 6mm thick carbide backing made no significant contribution to wheel wear. Grinding conditions and results are given in Figure 4 and Figure 5. It was found that the new bond technology reduced power consumption by 60% and increased G Ratio by 20%. The actual values for G Ratio were still in the range of 0.011 – 0.014

FIGURE 4:
DEDTRU SYSTEM AND GRINDING PARAMETERS



	BASELINE	NEW TECHNOLOGY
Wheel Diameter	104 mm	194 mm
Wheel Width	25 mm	25 mm
Wheel Spec	DED110CR16BXD	R09J13-1DAC110
Workpiece	PCD/TC 13.5 mm diam. 2 mm PCD layer 0.5Ra max	PCD/TC 13.5 mm diam. 2 mm PCD layer 0.5Ra max
Site Tolerance	25 um	25 um
Coolant	Trim Clear	Trim Clear
Wheel Speed	20 m/s	30 m/s
Reg Wheel	90 rpm	90 rpm
Radial Infeed	50 um/pass	50 um/pass
Feed Rate	1 m/min	1.25 m/min
G Ratio	0.011	0.014
Power	7 kW	2.6 kW
Overall Cost Saving		**30%**

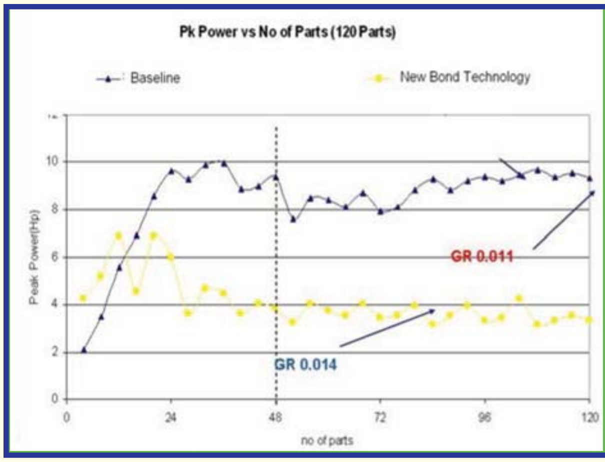


FIGURE 5: COMPARISON OF GRINDING POWER FOR THE BASELINE

comparable to that observed in the field. Stock removal was increased by 50% using the new bond technology but again was limited by the stiffness of the grind configuration. The appearance of the wheel surface (Figure 6) was much cleaner, more consistent, and less discolored indicative of less loading with the new bond technology. Significantly less stick dressing would be expected in production. A cost analysis of the process showed a potential incremental financial saving of perhaps 30% but the results suggested this be greatly enhanced with a more appropriate grinding system

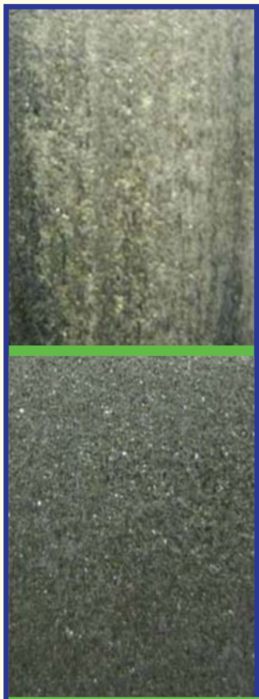


FIGURE 6: COMPARISON OF WORN AND NEW BOND TECHNOLOGY WHEELS WHEEL FACES FOR BASELINE (TOP) AND NEW BOND TECHNOLOGY (BOTTOM)

Evaluation of Wheel Performance on a the Viking Centerless Grinder

Evaluations were carried out on the Viking Centerless Grinder using full size production wheels 457mm x 254mm of the same specifications as tested above on the same PCD components. Wheel speed was also kept comparable at 33m/s. The regulating wheel was a 12” diameter rubber bonded wheel at a 2 degree angle; Thru-feed rates were controlled by the

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regulating wheel rpm only. Parts were fed through the grind in batches of 5. After some initial testing, it was found that the power was lowered by up to 30% with less risk of chipping of parts or damage to the blade by feeding the parts with the carbide end first. A series of tests were made until the optimal maximum stock removal rate was achieved based on roundness and process stability was achieved.

Discussion

When comparing the performance of wheels with low and ultra-stiff grinding systems, a number of striking benefits were noted:

- The Viking grinder raised the G Ratio and therefore life of both the baseline field wheel and the new bond technology by a minimum 250% and in the case of the new performance bond by over 400%. G Ratio appeared to even increase with increased removal rate over the range evaluated.
- The Viking grinder increased the maximum throughput of the baseline wheel by 165% and for the new bond technology wheel by 300% compared with test on the Dedtru and typical field results.
- The power was again observed to be significantly lower with the new bond technology. It was also found to be independent of feed rate between 0.5m/min and 2m/min
- Wheel cleaning was an effective adjunct to the high –stiffness system by increasing the G Ratio and keeping the wheel face open enough that secondary stick conditioning was not necessary.
- Observation of the wheel wear profile of the wheel showe that over the course of the experiment the baseline wheel developed a wear taper of about 10um as typically seen in the field and often the cause for redressing. The new bond technology wheel maintained a straightness of <2um over the same period of testing. ■

	BASELINE	BASELINE WHEEL CLEANING	NEW TECHNOLOGY	NEW TECHNOLOGY WHEEL CLEANING
Wheel Diameter	457mm	457mm	457mm	457mm
Wheel Width	254mm	254mm	254mm	254mm
Wheel Spec	DED110CR16BXD	DED110CR16BXD	R09J13-1DAC110	R09J13-1DAC110
Workpiece	PCD/TC 12.7mm diameter 2mm PCD layer 0.5Ra Max	PCD/TC 12.7mm diameter 2mm PCD layer 0.5Ra Max	PCD/TC 12.7mm diameter 2mm PCD layer 0.5Ra max	PCD/TC 12.7mm diameter 2mm PCD layer 0.5Ra max
Size Tolerance	25um	25um	25um	25um
Coolant	soluble oil	soluble oil	soluble oil	soluble oil
Dressing	thru-feed PCD parts	thru-feed PCD parts	thru-feed PCD parts	thru-feed PCD parts
Wheel Speed	33m/s	33m/s	33m/s	33m/s
Regulating Wheel	20 rpm	20rpm	60 rpm	60rpm
Radial Infeed	125um/pass	125um/pass	125um/pass	125um/pass
Feed Rate	0.66m/min	0.66m/min	2m/min	2m/min
# of Parts Per Feed	5	5	5	5
G Ratio	0.03	0.035	0.035	0.058
Grinding Power		9KW		5KW

TABLE 1: GRIND CONDITIONS AND OPTIMIZED REMOVAL RATES ON THE VIKING GRINDER

Conclusion

The combination of an ultra-stiff grinding system and advances in ultra-strong bond technology offers a quantum jump in grinding performance for PCD centerless grinding by enhancing the quality of the improvements of both grinder and wheel. The result is a leap in productivity from increases in stock removal rates and wheel life by as much as 400%, plus the potential elimination of stick dressing, leading to a dramatic reduction in PCD manufacturing cost.

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Any company and/or individual in the diamond and/or cBN business which DOES NOT have an office and a local, state or province business license in the United States, Canada or Mexico is eligible for membership in this category. An International member shall have all the privileges of regular membership, except that he/she cannot vote at any membership meetings, participate in statistical reporting for the North American market, hold proxies or serve in any office in IDA. Annual fee for International Member is **$3990 per year**.

_______ Associate Membership

Available for companies having a principal office in the U.S.A., Canada or Mexico, which are ***providing products or services to companies within the superabrasive/ultra-hard material industry***, but are not engaged in selling, using or dealing in industrial diamonds, cubic boron nitride, compacted diamond/cbn, diamond film or products containing diamonds/cbn. An Associate member shall have all the privileges of regular membership, except that the Delegate cannot vote at any membership meetings, participate in statistical reporting for the North American market, hold proxies or serve in any office in IDA. Annual fee for an Associate is **$515 per year**.

_______ End User/Contractor Membership

Available for any global companies or individuals, which USE products classified as superabrasives or ultra-hard materials, but are *NOT ENGAGED IN SELLING* industrial diamonds, cubic boron nitride, compacted diamond/cbn, diamond film or products containing diamonds/cbn. An End User/Contractor member shall have all the privileges of regular membership, except that the Delegate cannot vote at any membership meetings, participate in statistical reporting for the North American market, hold proxies or serve in any office in IDA. Annual fee for an End User/Contractor is **$386 per year**.

_______ Academia/Research Membership

Any non-profit Academic institution or R & D organization is eligible for membership in this category. An Academia/ Research/ member shall have all the privileges of regular membership, except that the Delegate cannot vote at any membership meetings, participate in statistical reporting for the North American market, hold proxies or serve in any office in IDA. Annual fee for Academia/Research is **$155 per year**.

_______ Student Membership

Any FULL TIME Student *NOT ENGAGED IN SELLING* industrial diamonds, cubic boron nitride, compacted diamond/cbn, diamond film or products containing diamonds/cbn is eligible for membership in this category. A Student shall have all the privileges of regular membership, except that he/she cannot vote at any membership meetings, participate in statistical reporting for the North American market, hold proxies or serve in any office in IDA.Annual fee for a Student Membership is **$77 per year**.

_______ Senior Membership

Any individual who has worked for and/or retired from an IDA Member company or is no longer active in the diamond or CBN business is eligible for membership in this category. A senior member shall have all the privileges of regular membership, except that he/she cannot vote at any membership meetings, participate in statistical reporting, hold proxies or serve in any office in IDA. Annual fee for a Senior is **$52 per year**.

Name of Delegate Member: ____________________

Title: ____________________

E-Mail: ____________________

**** Applications for ALL Memberships are reviewed by the Board of Directors and must be approved by a two-thirds vote.***

_______ Affiliate Membership

Each company that enrolls as an IDA Member is entitled to have a second person at that company designated an Affiliate Member. The first Affiliate member will receive IDA material at no further cost. Additional persons at Member companies can be added as Affiliate Members to receive IDA materials. Annual fee for additional Affiliates is $98 per person. Name of 1st Affiliate Member (no charge):

Name of 1st Affiliate Member (no charge): ____________________

Name of 2nd Affiliate Member ($98): ____________________

Name of 3rd Affiliate Member ($98): ____________________

If your company wants more Affiliate Members, please attach additional sheets.

WHAT IS THE IDA?

The Industrial Diamond Association of America, Inc. **is a non-profit trade association and was incorporated on March 29, 1946 in the State of New York. It is the oldest and most prestigious association in the superabrasive/ultrahard materials industry. Activity and focus has evolved from natural diamond to superabrasives and most recently, to all ultrahard materials including CVD Diamond. Members include material suppliers, tool manufacturers, component producers, machine tool builders, end users, academia/research affiliates and other companies related to the research, manufacture, application, use and sales of superabrasives.**

WHAT DOES THE IDA DO?

- **Oversees Statistics Reporting Program**
- **Establishes Industry Standards**
- **Interacts With Global Associations And Organizations**
- **Creates And Distributes Market Studies & Data**
- **Organizes And Presents Technical Seminars & Conferences**
- **Serves As A Government Liaison For Industry Guidelines And Regulations**
- **Participates As Member Of World Diamond Council**
- **Provides Safety / Regulatory Reports And Advisement**
- **Resource For General Information And Consultation**

OTHER MEMBER SERVICES

- **PUBLISHES QUARTERLY MAGAZINE**
- **HOLDS ANNUAL CONVENTIONS**
- **HOSTS IDA WEBSITE WITH MEMBER FOCUS AND DIRECTION**
- **PROVIDES SPECIFIC ASSISTANCE ON INDIVIDUAL MEMBER ISSUES**
- **CREATES AND DISTRIBUTES PUBLICATIONS ON PRODUCTS AND APPLICATIONS**
- **ACTS AS A COLLECTIVE VOICE FOR INDUSTRY CONCERNS**

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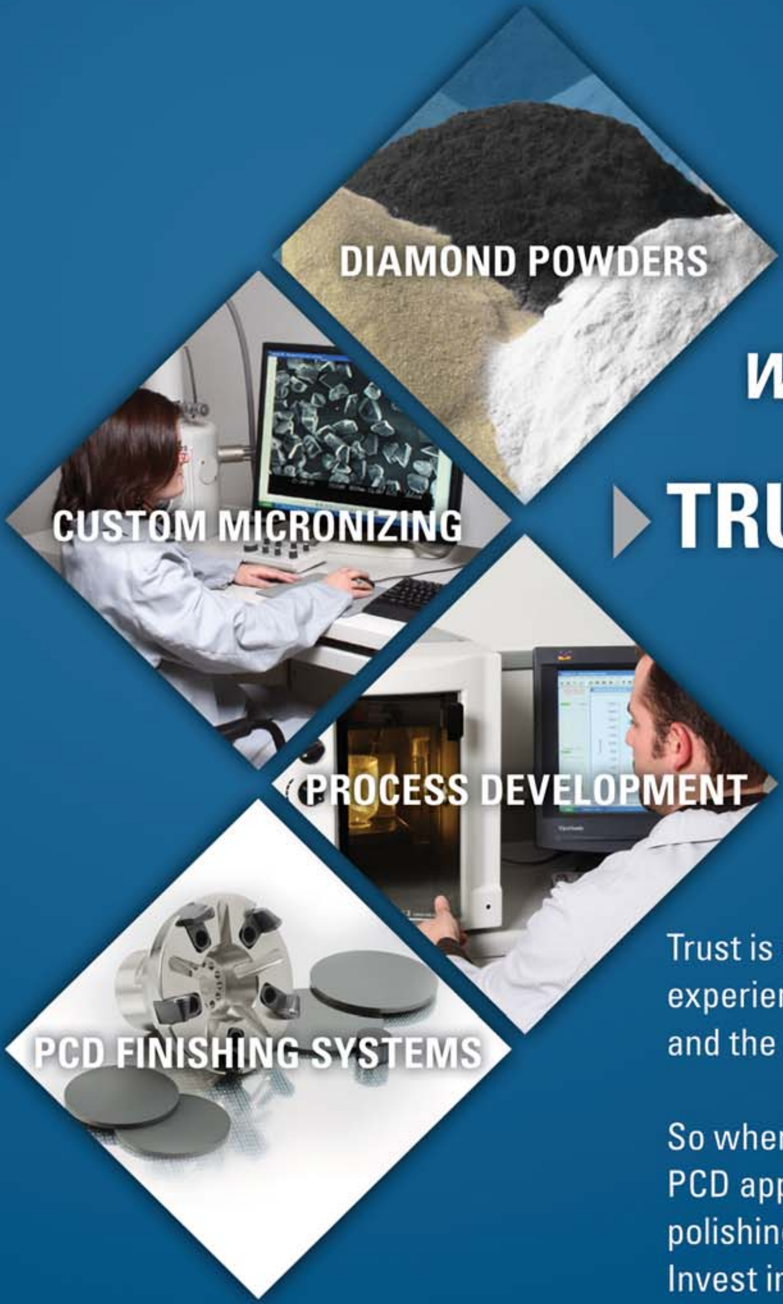
The Industrial Diamond Association of America and the IDA Board of Directors announces winner of iPad2 for participation in the Finer Points survey.

The IDA congratulates Dan Scott of Baker Hughes and thanks Dan for his participation and help in providing valuable information which will continue to improve the Finer Points for its readers. To quote Dan: *"I always look forward to the INTERTECH Conferences and the Finer Point magazine produced by the IDA. The balance of articles on new technology or applications of superabrasives across the industry segments is good and I find them a source of ideas, as well as the information from your advisors. I have not only read this journal for many years, but have kept them as a reference source for new hires and in mentoring and training opportunities. I will enjoy the use of my new IPad"* ... Dan has been with Baker Hughes 42 years and is currently a Senior Technical Adviser. He received the Baker Hughes Chairman's Lifetime Technology Achievement Award in 2009, and is a Fellow in ASM International, has received the ASME Silver Patent Award for Contributions to the Petroleum industry in 2006, and has recently been named a Distinguished Member of SPE, one of their highest honors. He also serves on the Industrial Advisory Board to the Petroleum Engineering Department at MS&T University. He holds over 70 US patents, has published over 40 papers and has been a contributor to Finer Points and presenter at INTERTECH over the years ...

CHECKLIST *of things to do...*

FINER POINTS

- ☐ Renew my subscription to Finer Points magazine.
- ☐ Reserve my ad space in the next Finer Points issue.
- ☐ Submit article for consideration in future issue of Finer Points.
- ☐ Send Finer Points my business news, new products, new hires, promotions, industry news and other press release items.
- ☐ Send in my membership application to the IDA.
- ☐ Refer a company to IDA for consideration as a member.
- ☐ Visit the IDA Website at: www.superabrasives.org and submit a question or comment.
- ☐ Contact an IDA member for products or services.



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* Grinding tests conducted by Element Six with ABN900 50/60 US Mesh show the potential for extending tool life by up to 35%. Tests using ABN900 120/140 US Mesh show the potential for extending tool life by up to 55%. Contact Element Six for details of these tests, product samples and results.

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